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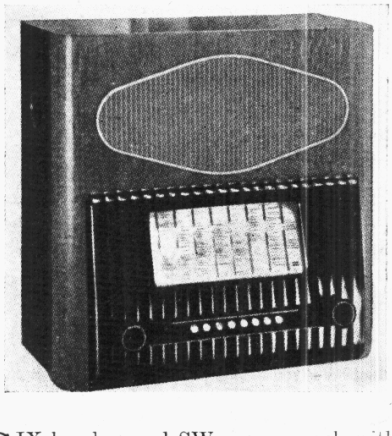
"TRADER" SERVICE SHEET 643

MURPHY A92

EIGHT-BAND PRESS-BUTTON SUPERHET



SIX band-spread SW ranges, each with its own scale, bearing station names, are the outstanding feature of the Murphy A92. Waveband switching for these and the MW and LW bands is accomplished by a press-button switch unit operated by eight buttons. All tuning coils throughout the receiver have adjustable iron-dust cores, and the inter-valve coupling on SW between **V1** and **V2** automatically suppresses image signals. A rejector link, in the aerial circuit, may be replaced by a local station wave-trap.

The receiver is on MW and LW a 4-valve (plus rectifier) superhet, but on all SW bands an additional RF amplifying stage is introduced. The standard set is designed to operate from AC mains of 200-250 V, 50-100 c/s. A separate model is made for 100-110 V, 50-100 c/s mains.

Release date and original price: April, 1940; £15 15s.

CIRCUIT DESCRIPTION

Switching for the eight wavebands in this receiver is performed by an eight-gang press-button unit, and entails ninety switches. These switches have only a two-way action; they close in one position and open in the other; they are operated in groups, each group being controlled by a single press-button.

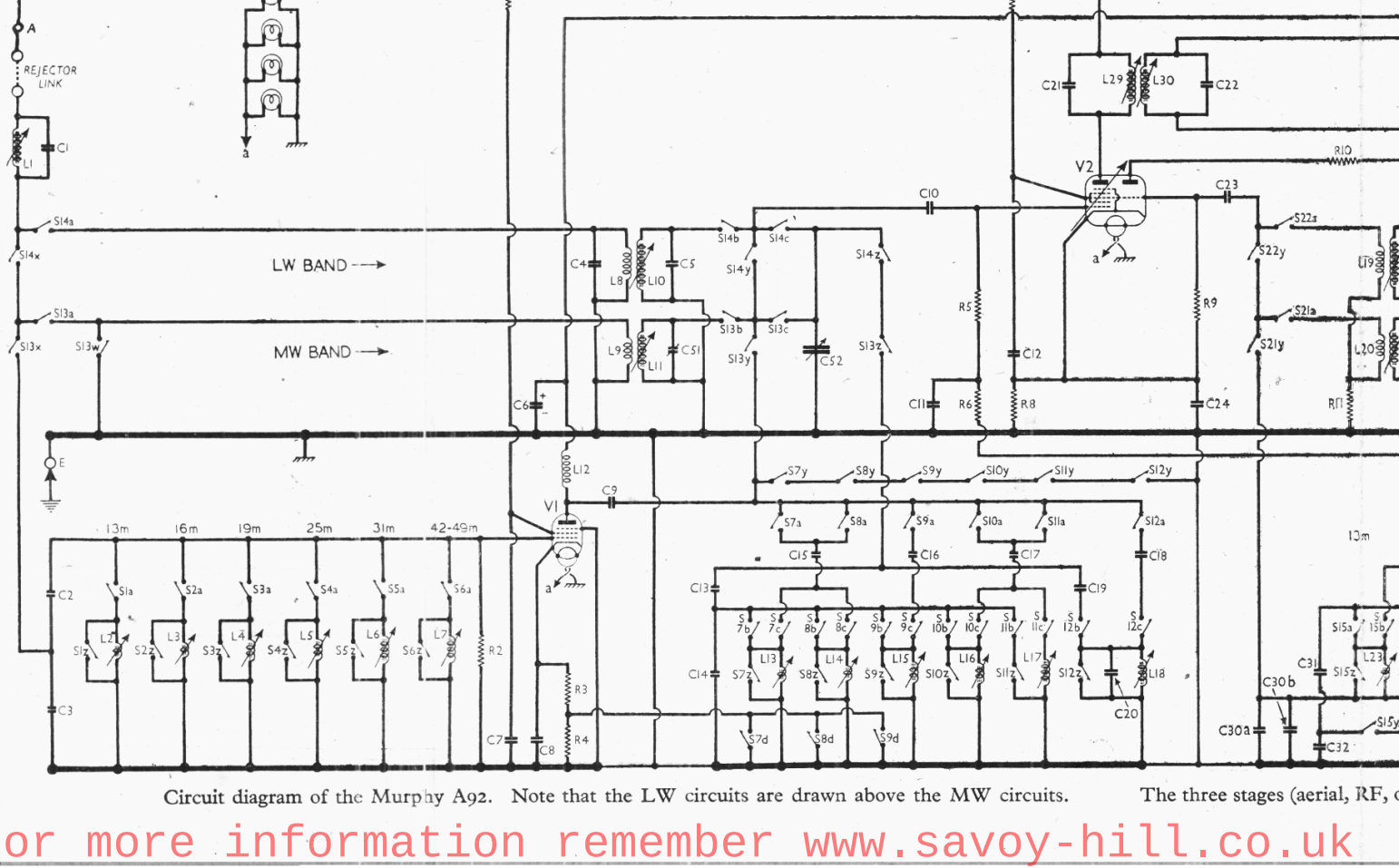
Advantage has been taken of these conditions to render their action apparent from a study of the circuit diagram, and for this purpose they have been coded as follows: All switches contained in a given group bear the same number and operate at the same time from the same button.

The individual switches in a group are identified by a lettered suffix: **a, b, c, d** and **w, x, y, z.** Any switch bearing the suffix **a, b, c** or **d** *closes* when its button is pressed, while one with the suffix **w, x, y** or **z** *opens.* When the button is released by depression of another button, the position is reversed. Normally, therefore, with the exception of switches associated with the button which is depressed at the time, all **w, x, y** and **z** switches may be read in the diagram as being closed.

Of the eight buttons, the MW button controls two switch groups, one in the aerial circuit (**S13** group) and one in the oscillator circuit (**S21** group); the LW button also controls two similar groups (**S14** and **S22**); the six SW band buttons each control three groups, one in the aerial circuit **(S1-S6),** one in the RF amplifier circuit **(S7-S12)** and one in the oscillator circuit **(S15-S20).**

Aerial input on MW and LW is via IF rejector circuit **L1, C1, S14a** and coupling coil **L8** (LW), or via **S14x, S13a** and coupling coil **L9** (MW) to single tuned circuits **L10, C52** (LW) and **L11, C52** (MW), which directly precede triode heptode valve **(V2, Mazda metallised TH41)** operating as frequency changer with internal coupling. It should be noted that the LW circuits appear in our diagram above the MW circuits, which is contrary to our usual practice.

On the six SW bands, the frequency changer is preceded by a pentode RF amplifier **(V1, Mazda metallised SP41),** whose control grid is tuned by aperiodic circuits comprising coils **L2-L7,** according to which button is depressed, and



Circuit diagram of the Murphy A92. Note that the LW circuits are drawn above the MW circuits. The three stages (aerial, RF, c

condensers **C2, C3.** Aerial input is tapped in at the junction of **C2** and **C3,** via **S14x, S13x.**

The output from **V1** is choke-capacity coupled by **L12, C9** to **V2** heptode control grid, which is tuned by **L13-L18** and **C52,** with band-spreading by **C13, C14** on the 13 m, 16 m, 19 m, 25 m and 31 m bands, and by **C19, C20** on the 42-49 m band, **C52** being connected via **S14z** and **S13z.** Coupling is via special condensers **C15-C18,** according to the band in use, via **S13y, S14y.**

On the 13 m, 16 m and 19 m bands, **S7d, S8d** and **S9d** short-circuit **R4** and reduce the GB to **V1.** On MW and LW bands (when all the SW buttons are out) **S7y-S12y** short-circuit the output from **V1.**

On MW and LW, **V2** triode oscillator anode coils **L22** (MW) and **L21** (LW) are tuned by **C55.** Parallel trimming by **C54** (MW) and **C25, C53** (LW); series tracking by **C28** (MW) and **C27** (LW). A small fixed condenser **C29** is connected in shunt with **C55.** Reaction coupling by grid coils **L20** (MW) and **L19** (LW) via stabilising resistor **R11.** A small stabilising resistor **R10** is included also in the anode lead.

The SW oscillator coils **L23-L28** are variably tuned by **C55,** with band-spreading by series condensers **C34** (42-49 m band), **C33** (other bands) and **C30a, C30b** (all bands); and parallel condensers **C31, C32; C32** being short-circuited on all but the 13 m and 42-49 m bands by **S15y** and **S20y.** The oscillator anode (via **S22z, S21z**) and control grid (via **S22y, S21y**) are connected respectively to either end of the coil in use, and reaction coupling is established across the common impedance of **C30a, C30b** in grid and anode circuits. **C30** is divided into the two components **a** and **b** to minimise drift.

Third valve **(V3, Mazda metallised VP41)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings, **C21, L29, L30, C22** and **C37, L31, L32, C38.** The condensers are fixed and, in common with all tuning coils in this receiver, the inductances are variable by means of adjustable iron-dust cores.

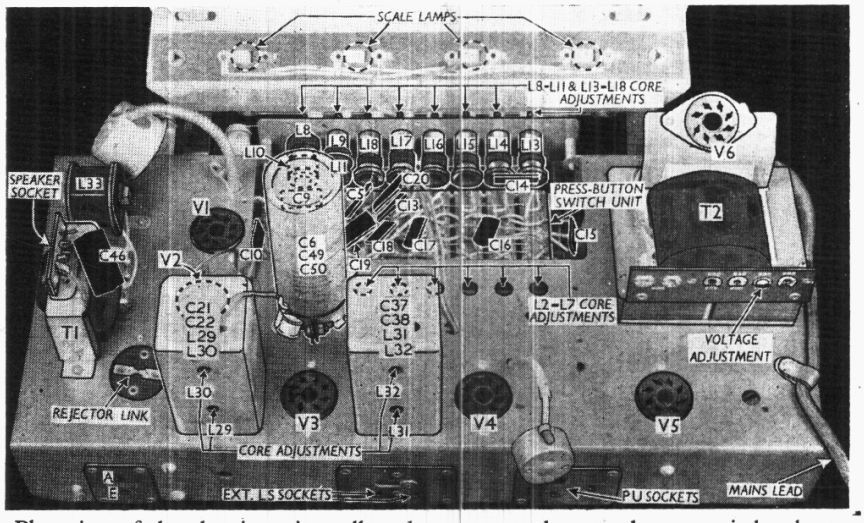
Intermediate frequency 465 kc/s.

Diode second detector is part of double diode triode valve **(V4, Mazda metallised HL41DD).** The second diode is strapped to chassis. Audio-frequency component in rectified output is developed across load resistor **R17** and passed via AF coupling condenser **C43** and manual volume control **R18** to CG of triode section, which operates as AF amplifier. IF filtering by **C40, R15** and **C41.** Provision for connection of gramophone pick-up across **R18.**

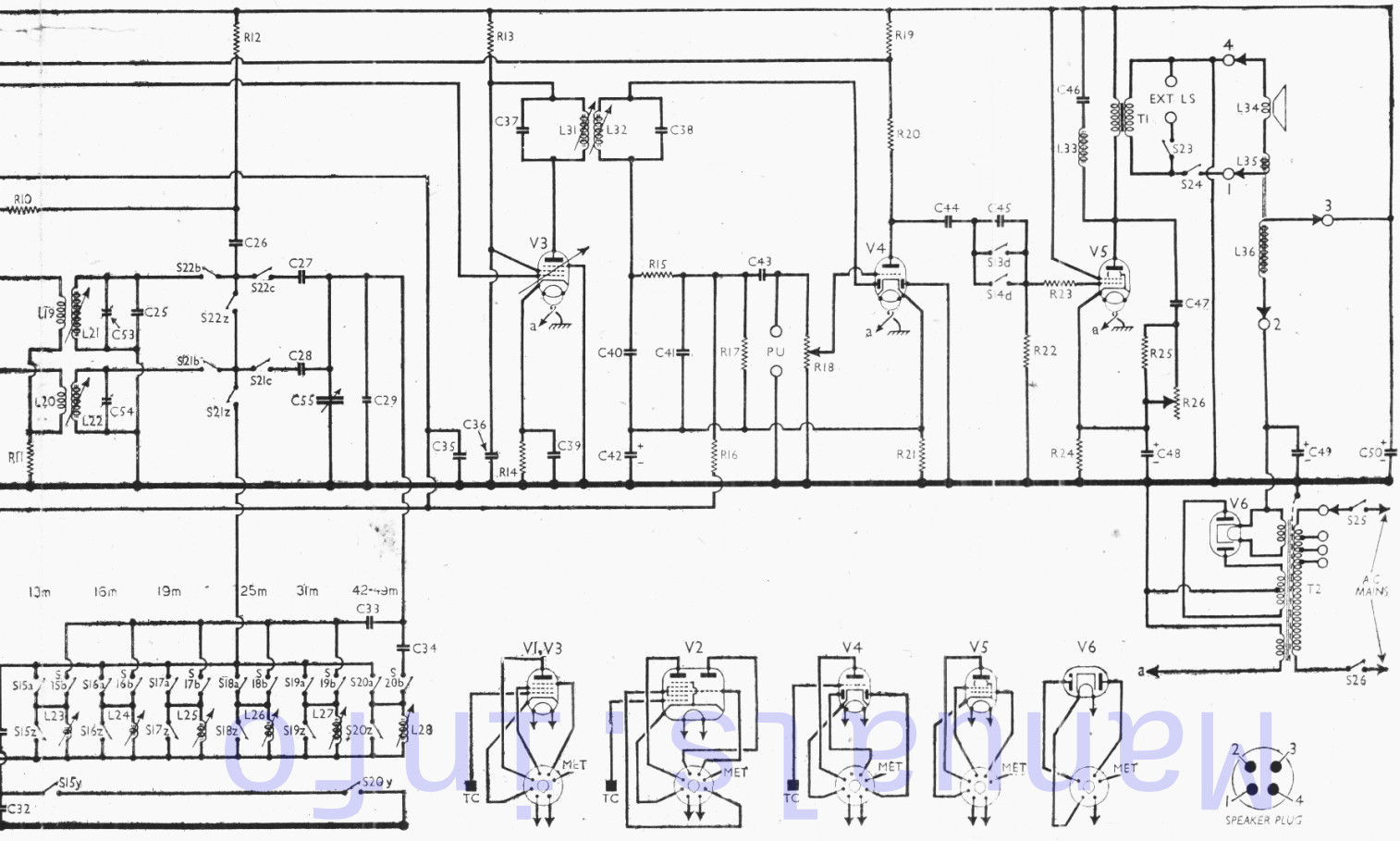
DC potential appearing across **R17** is tapped off and fed back through decoupling circuits as GB to FC and IF valves on all bands, giving automatic volume control. It should be observed that the fixed negative GB applied from their cathode circuits to the controlled valves will be partly off-set by the positive potential of **V4** cathode.

Resistance-capacity coupling on MW and LW by **R20, C44** and **R22,** between **V4** triode and beam tetrode output valve **(V5, Mazda Pen45).** On SW bands **C45** is interposed between **C44** and **R22.** Whistle suppression by filter **C46, L33** in anode circuit. Provision for connection of low-impedance external speaker via **S23** across **T1** secondary, and for muting the internal speaker by **S24,** if desired. Variable tone control by **R26, R25** and **C47** in anode circuit.

HT current is supplied by full-wave IHC rectifying valve **(V6, Mazda metallised UU6).** Smoothing by speaker field **L36** and electrolytic condensers **C49, C50.**



Plan view of the chassis. A cardboard cover over the press-button unit has been removed. **C9** and **L10** are shown dotted through **C6, C49, C50** unit.



rial, RF, oscillator) of the six band-spread SW circuits are drawn below the main chassis line. Note that **S13d, S14d** are across **C45.**

VALVE ANALYSIS

Valve voltages given in the table below are those quoted in the makers' manual. The currents have been computed from associated information, as they are not quoted in the manual. In both cases the figures are approximate, but may be taken as a reliable guide.

The conditions under which voltages were measured are not quoted, except that the 500 V scale of a 1,000 ohms-per-volt meter was used with its negative lead connected to chassis, but the receiver should be operating with no signal input and the 19 m band button depressed.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 SP41	240	9·4	190	2·3
V2 TH41	250	2·1	100	5·5
	Oscillator			
	100	4·5		
V3 VP41	200	6·5	200	2·0
V4 HL41 DD	100	2·2	—	—
V5 Pen45	240	34·5	250	5·5
V6 UU6†	—	—	—	—

† Cathode to chassis, 360V, DC.

DISMANTLING THE SET

Removing Chassis.—Remove the two control knobs (recessed grub screws) from front of cabinet, and the tone control knob (recessed screw inside cabinet) from the side of the cabinet;

remove tone control and bracket (two round-head screws) from side of cabinet, freeing its leads from the cleat below;

withdraw speaker plug from its socket on the output transformer;

remove the two round-head set screws (with washers) holding brackets at top of scale assembly to front of cabinet;

remove the four slotted hexagon bolts (with large metal washers) holding chassis to bottom of cabinet.

When replacing, a felt washer should go on to each press-button, before inserting the chassis, and a large one should go on to each of the front control spindles, between knob and cabinet.

Removing Speaker.—Withdraw connecting plug, and free leads from cleat on front of cabinet; then remove the four nuts holding speaker to sub-baffle.

When replacing, the leads should emerge from the left.

COMPONENTS AND VALUES

	RESISTORS	Values (ohms)
R1	V1 SG HT feed	22,000
R2	V1 CG resistor	100,000
R3	V1 GB resistors	220
R4	V1 GB resistors	820
R5	V2 Heptode CG resistor	1,000,000
R6	V2 Heptode CG decoupling	4,700
R7	V2 SG HT feed	27,000
R8	V2 fixed GB resistor	330
R9	V2 osc. CG resistor	22,000
R10	V2 osc. anode stopper	20
R11	Osc. reaction damping	470
R12	V2 osc. anode HT feed	33,000
R13	V3 SG HT feed	4,700
R14	V3 fixed GB resistor	470
R15	IF stopper	100,000
R16	AVC line decoupling	1,000,000
R17	V4 diode load	470,000
R18	Manual volume control	1,000,000
R19	V1, V4 anodes HT feed	4,700
R20	V4 triode anode load	47,000
R21	V4 triode GB resistor	680
R22	V5 CG resistor	150,000
R23	V5 grid stopper	47,000
R24	V5 GB resistor	200
R25	Variable tone control	10,000
R26	Variable tone control	50,000

	CONDENSERS	Values (μF)
C1	Aerial IF rejector tuning	0·0005
C2	Aperiodic aerial SW tuning and coupling condensers	0·00002
C3	Aperiodic aerial SW tuning and coupling condensers	0·000045
C4	LW resonance shift	0·0005
C5	Aerial LW trimmer	0·0001
C6*	V1, V4 anodes decoupling	8·0
C7	V1 SG decoupling	0·01
C8	V1 cathode by-pass	0·01
C9	SW coupling to V2	0·0002
C10	V2 hept. CG condenser	0·0002
C11	V2 hept. CG decoupling	0·05
C12	V2 SG decoupling	0·05

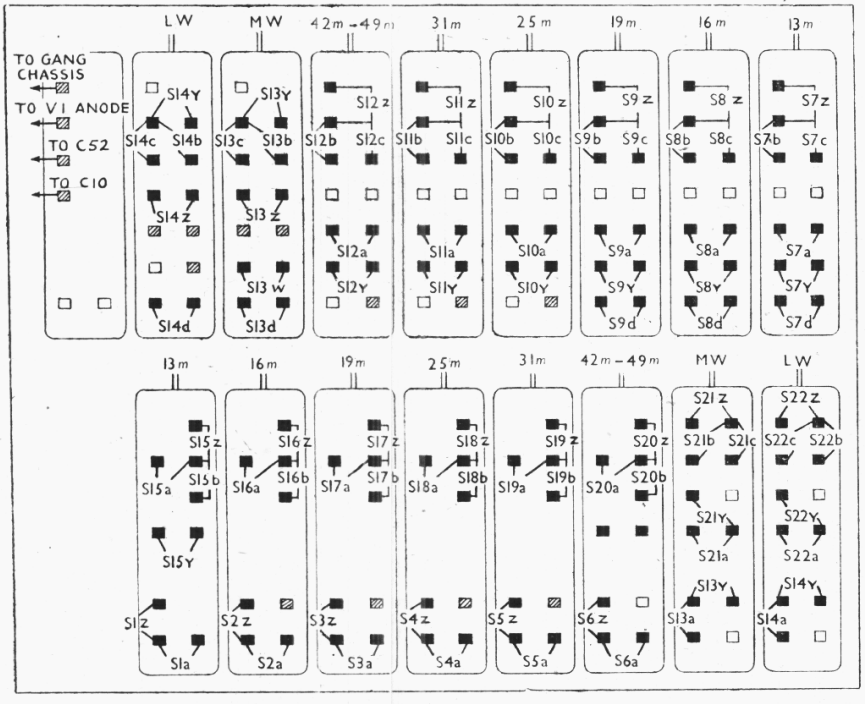
(*continued next column*)

* Electrolytic.

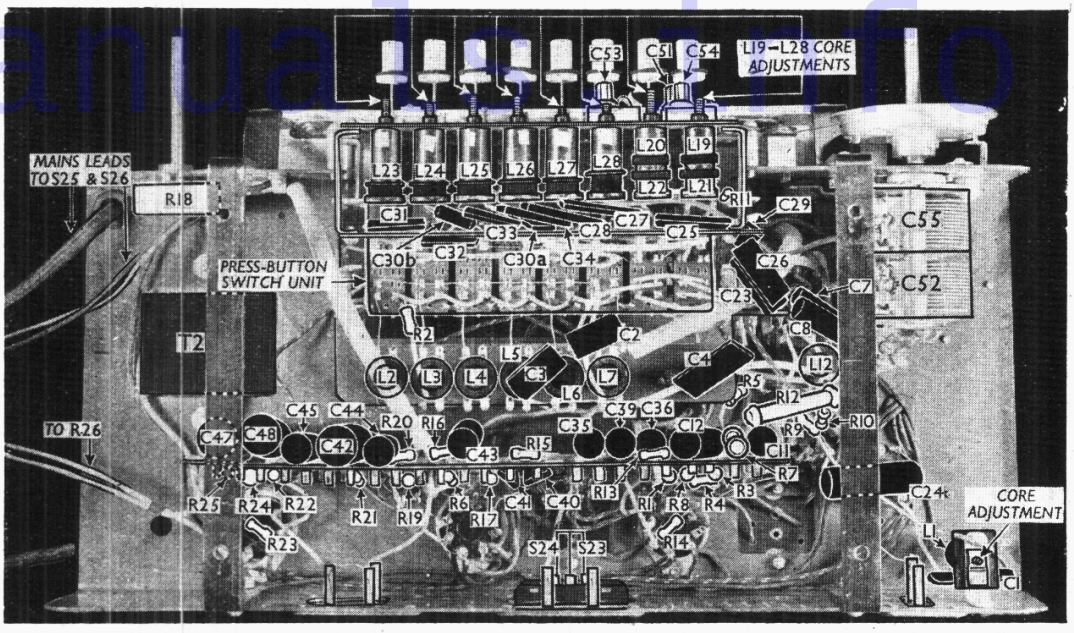
	CONDENSERS (*continued*)	Values (μF)
C13	RF SW1—5 tracker	0·000018
C14	RF SW fixed tuning	0·00003
C15	RF SW coupling condensers	0·000016
C16	RF SW coupling condensers	0·000022
C17	RF SW coupling condensers	0·000033
C18	RF SW coupling condensers	0·000125
C19	RF SW6 tracker	0·000175
C20	RF SW6 trimmer	0·0002
C21	1st IF trans. tuning condensers	0·000139
C22	1st IF trans. tuning condensers	0·00015
C23	V2 osc. CG condensers	0·0002
C24	V2 cathode by-pass	0·05
C25	Osc. LW fixed trimmer	0·00023
C26	V2 osc. anode coupling	0·0001
C27	Osc. circuit LW tracker	0·000414
C28	Osc. circuit MW tracker	0·000662
C29	Osc. tuning shunt	0·00001
C30a	Osc. SW CG coupling condensers	0·0001
C30b	Osc. SW CG coupling condensers	0·0001
C31	Osc. SW fixed tuning condensers	0·0002
C32	Osc. SW fixed tuning condensers	0·0002
C33	Osc. SW1-5 tracker	0·000125
C34	Osc. SW6 tracker	0·000626
C35	AVC line decoupling	0·05
C36	V3 SG decoupling	0·05
C37	2nd IF trans. tuning condensers	0·000139
C38	2nd IF trans. tuning condensers	0·00015
C39	V3 cathode by-pass	0·05
C40	IF by-pass condensers	0·0001
C41	IF by-pass condensers	0·0001
C42*	V4 cathode by-pass	50·0
C43	AF coupling to V4 triode	0·01
C44	V4 triode to V5 AF coupling	0·025
C45	V4 triode to V5 AF coupling	0·003
C46	Whistle filter condenser	0·00085
C47	Part variable tone control	0·08
C48*	V5 cathode by-pass	50·0
C49*	HT smoothing condensers	16·0
C50*	HT smoothing condensers	8·0
C51‡	Aerial MW trimmer	0·000035
C52‡	Aerial and RF tuning	—
C53‡	Osc. circuit LW trimmer	0·000035
C54‡	Osc. circuit MW trimmer	0·000035
C55†	Oscillator circuit tuning	—

* Electrolytic. † Variable. ‡Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial IF rejector coil	2·5
L2	Aerial 13m band coil	Very low
L3	Aerial 16m band coil	Very low
L4	Aerial 19m band coil	0·1
L5	Aerial 25m band coil	0·2
L6	Aerial 31m band coil	0·25
L7	Aerial 42–49m band coil	0·3
L8	Aerial LW coupling	25·0
L9	Aerial MW coupling	0·7
L10	Aerial LW tuning	15·0
L11	Aerial MW tuning	2·25
L12	V1 anode RF choke	5·0
L13	RF 13m band coil	Very low
L14	RF 16m band coil	Very low
L15	RF 19m band coil	0·1
L16	RF 25m band coil	0·15
L17	RF 31m band coil	0·25
L18	RF 42–49m band coil	0·3
L19	Osc. LW reaction coil	0·9
L20	Osc. MW reaction coil	0·8
L21	Osc. LW tuning coil	1·7
L22	Osc. MW tuning coil	1·25
L23	Osc. 13m band coil	Very low
L24	Osc. 16m band coil	Very low
L25	Osc. 19m band coil	0·05
L26	Osc. 25m band coil	0·1
L27	Osc. 31m band coil	0·1
L28	Osc. 42–49m band coil	0·15
L29	1st IF trans. Pri.	5·5
L30	1st IF trans. Sec.	5·5
L31	2nd IF trans. Pri.	5·5
L32	2nd IF trans. Sec.	5·5
L33	Whistle filter coil	250·0
L34	Speaker speech coil	3·0
L35	Hum neutralising coil	0·1
L36	Speaker field coil	1,600·0
T1	Out trans. Pri.	290·0
	Out trans. Sec.	0·7
T2	Mains trans. Pri., total	22·0
	Mains trans. Heater sec.	Very low
	Mains trans. Rect. heat. sec.	0·1
	Mains trans. HT sec., total	445·0
S1a to S22z,	Press-button waveband switches	—
S23	External speaker switch	—
S24	Internal speaker switch	—
S25, S26	Mains switches, ganged R26	—



Diagrams showing in detail the two sides of the press-button switch unit; above, that seen from above the chassis; below, that seen from below. In both cases they are viewed from the rear, as seen in the photographs. Black squares indicate switch connections, white squares blank tags, and shaded squares bearer tags.



Under-chassis view. **C51**, **C53** and **C54** adjustments are indicated. The complete tuning unit, which can be removed as a whole, is shown outlined. It includes two rows of coils, **L19-L28** and **L2-L7**, and the press-button unit. Normally a metal screen covers the front part of the tuning unit. The location of many small components is facilitated by counting the tags, which are clearly seen, along the horizontal assembly behind the tuning unit.

GENERAL NOTES

Switches.—All the waveband switching is contained in the press-button unit, an eight-section assembly mounted on a self-contained tuning unit mounted on the front chassis member. The switches form themselves conveniently into groups, according to their purpose, and each group is completely contained in one section of the assembly, with one or two other groups, the whole section being operated by one press-button.

Diagrams in cols. 1 and 2 show the two sides of the unit in detail, the upper one showing the side visible from above the chassis, and the lower one the underside, being drawn in both cases as seen from the rear, as in our chassis illustrations.

The action of the switches is fully described in our "Circuit Description" overleaf, and can be seen from an inspection of the circuit diagram when the explanation has been read.

S23, S24 are the speaker switches, mounted on a panel with the external speaker sockets at the rear of the chassis. The sliding control knob has three positions: left, **S23** closed, **S24** open; centre, both switches closed; right, **S23** open, **S24** closed.

S25, S26 are the QMB mains switches, ganged with the tone control **R26.** This unit is mounted on the side of the cabinet, so that it is not shown in our chassis illustrations, but the leads to it are indicated in our under-chassis view.

Coils.—All tuning coils throughout the receiver have adjustable iron-dust cores, from **L1** to **L32**, and their adjustments are indicated in our chassis illustrations. Sixteen of these adjustments, together with three pre-set condenser adjustments, are accessible only from the front of the chassis, and if the large moulded escutcheon is removed, upon removal of seven round head set screws (three beneath the cabinet and four inside the cabinet, two of which hold the top of the scale assembly) they can be reached without removing the chassis. The remaining adjustments, with the exception of **L1**, are reached through holes in the chassis deck. **L1** is adjusted from beneath the chassis.

L1 is the aerial IF rejector coil mounted beneath the chassis beside the aerial socket. **L2-L7, L8-L11, L13-L18,** and **L19-L28** are the RF and oscillator coils in three rows on the tuning unit, each stage of each waveband being wound on its own moulded bobbin. The IF transformers **L29, L30** and **L31, L32** are in two screened units on the chassis deck, their core adjustments facing rearwards. The whistle filter coil **L33** is mounted on the chassis deck. This also has an adjustable iron-dust core, but it is fixed at works and should not be disturbed.

Scale Lamps.—These are four Osram MES type lamps, rated at 6.2 V, 0.5 A, with large spherical bulbs. They are mounted on a strip of insulating material at the top of the scale assembly, and the whole row may be withdrawn upon removal of the two press-studs at the ends of the strip.

External Speaker.—Two sockets are provided at the rear of the chassis for the connection of a low impedance (3-7 Ω) external speaker. Switches **S23, S24** permit either or both speakers to operate.

Speaker Connections.—The speaker is connected to chassis by means of a four-pin plug and socket, the socket being mounted on the output transformer **T1.** The points of interconnection are indicated in the circuit diagram by numbered arrows and circles, and a diagram appears beneath the circuit showing the plug as viewed from the free ends of the pins.

Condensers C30a, C30b.—These are two 0.0001 μF condensers of different types connected in parallel to provide a total capacity of 0.0002 μF. **C30a** is of the silvered mica type, while **C30b** is a special ceramic condenser with a tolerance of ± 3 per cent.

Condensers C6, C49, C50.—These are three dry electrolytics in a single tubular cardboard container mounted on the chassis deck. Of the leads, which emerge beneath the chassis, the red one is the positive of **C49** (16 μF, 500 V working), and the two yellow ones the positives of **C6** and **C50** (each 8 μF, 450 V working). The black lead is the common negative.

R26, S25, S26.—These are the tone control and mains switches. The switches are ganged with the tone control, which is mounted on the side of the cabinet. The unit is not seen in our chassis illustrations, but the leads to it are indicated in the under-chassis view.

Chassis Divergencies.—The makers state that in early models **R10** may be 10 Ω or 12 Ω. It was subsequently increased to 20 Ω in order to avoid parasitic oscillation on the 13 m and 16 m bands. In addition, in some models, **L12** may be connected directly to the HT positive line instead of to the junction of **R19** and **R20.**

In an early diagram **R4** is omitted, and instead a 680,000 Ω resistor was inserted between **R1** and the HT positive line. The switches **S7d, S8d** and **S9d** were then connected across the 680,000 Ω resistor instead of across **R4.** In our chassis, **S7y-S12y** were connected as shown in in our diagram to short-circuit **V1** output on MW and LW, but in their manual the makers show no connection between **S7y** and **C9,** although the rest of the wiring is retained.

CIRCUIT ALIGNMENT

IF Stages.—Unless an oscilloscope is to be used for the IF stages, a damping shunt, with crocodile clips at its ends, should be made up by connecting 20,000 Ω resistor and a 0.1 μF condenser in series before IF adjustments are commenced.

Connect the signal generator leads to **V3** control grid (top cap) and chassis, and the damping shunt to **V3** anode (pin 3) and chassis, feed in a 465 kc/s (645.16 m) signal, and adjust **L32** core for maximum output. Transfer upper clip of shunt to **V4** signal diode (pin 5), and adjust **L31** core for maximum output.

Transfer signal generator lead to control grid (top cap) of **V2,** and the shunt clip to **V2** heptode anode (pin 3), and adjust **L30** core for maximum output. Transfer shunt clip to **V3** control grid (top cap), and adjust **L29** core for maximum output. Remove shunt.

IF Rejector.—Transfer signal generator leads to **A** and **E** sockets and adjust its output until the signal is just audible in the speaker. Now adjust **L1** core for minimum output.

RF and Oscillator Stages.—With the gang at maximum or minimum, the full width of the red cursor line should be visible at top and bottom of the five longer waveband scales. A suitable dummy aerial should be inserted in the aerial lead.

MW.—Press the MW button, tune to 230 m on scale, and feed in a 230 m (1,300 kc./s) signal. Now adjust **C54** to correct any calibration errors; then **C51** for maximum output. Tune to 500 m on scale, feed in a 500 m (600 kc/s) signal, and adjust **L22** and **L11** cores if necessary for correct alignment. If the adjustments are large, return to 230 m and repeat.

LW.—Press the LW button, tune to 1,000 m on scale, feed in a 1,000 m (300 kc/s) signal, and adjust **C53** to correct any tracking error. Tune to 1,900 m on scale, feed in a 1,900 m (158 kc/s) signal, and adjust **L21** and **L10** to correct alignment errors. If the adjustment is large, return to 1,000 m and repeat.

SW Bands.—The SW trimming is extremely critical, and is carried out in the factory with the aid of crystal controlled oscillators. If adjustment is necessary, therefore, the makers advise that a known station should be tuned in carefully, and the appropriate oscillator coil core **(L23-L28)** accurately adjusted until the scale reading is correct.

When the oscillator circuit is correctly adjusted, connect the signal generator in place of the aerial and earth, feed in a suitable signal, and tune it in carefully. Then adjust the RF inductances **(L13-L18)** and aerial inductances **(L2-L7)** for optimum settings. The table below gives the wavelength and frequency used for this adjustment for each band at the factory, and it is advisable that these should be used. On no account should the oscillator settings be disturbed.

Band	Wavelength (m)	Frequency (Mc/s)	Osc. Coil	RF Coil	Aerial Coil
13 m	13·96	21·5	L23	L13	L2
16 m	16·87	17·8	L24	L14	L3
19 m	19·66	15·25	L25	L15	L4
25 m	25·3	11·86	L26	L16	L5
31 m	31·2	9·61	L27	L17	L6
42-49 m	49·18	6·1	L28	L18	L7

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